(No Model.)

A. E. FEROE.

PROCESS OF AND APPARATUS FOR TREATING MALT LIQUORS.

No. 568,132. Patented Sept. 22, 1896.

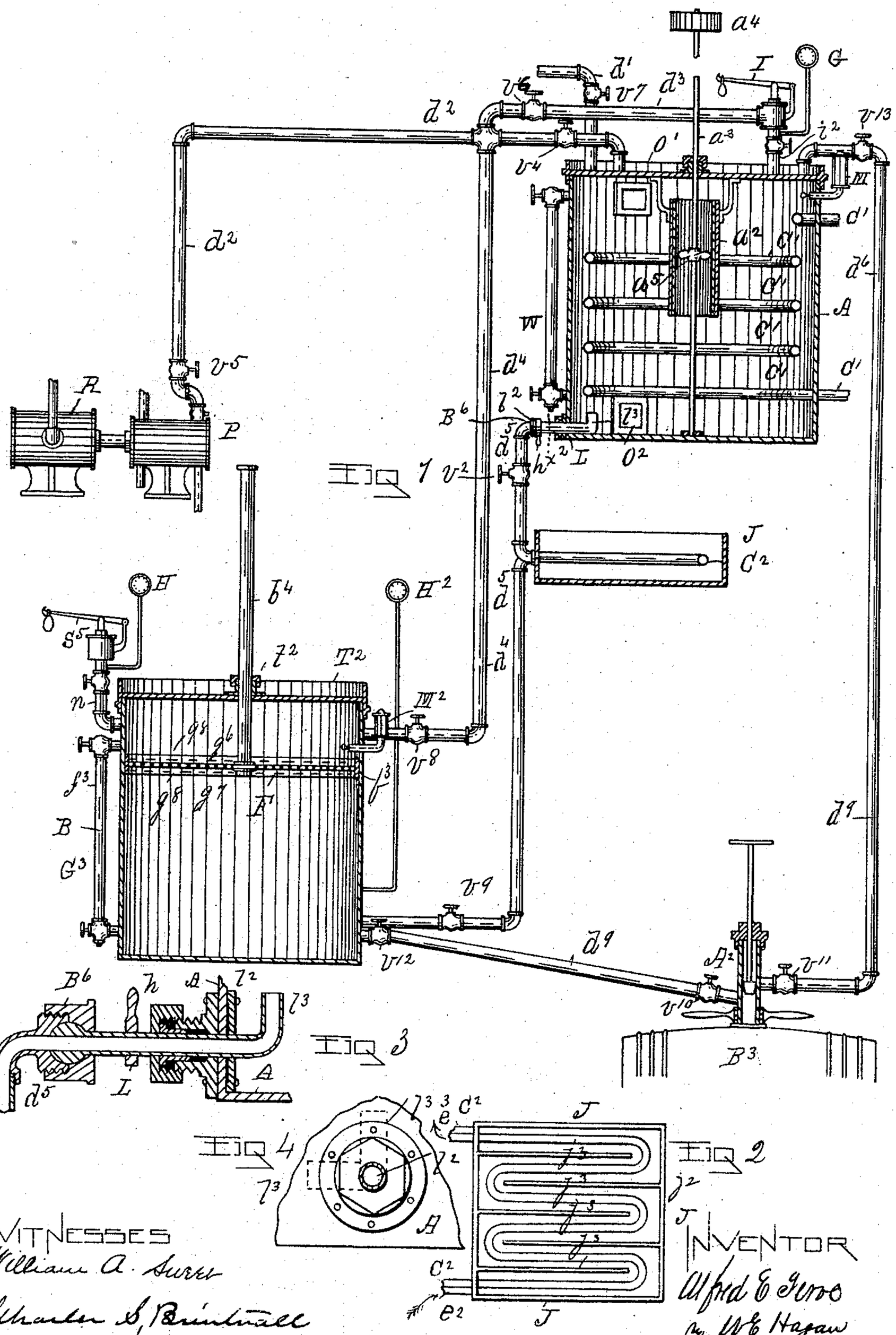

Fig 3

Fig 4

Fig 2

WITNESSES
William A. Sure
Charles S. Brinnell

INVENTOR
Alfred E Feroe
by W E Hagan
Atty

UNITED STATES PATENT OFFICE.

ALFRED E. FEROE, OF MADALIN, NEW YORK, ASSIGNOR TO FEROE BROTHERS & CONWAY, OF TROY, NEW YORK.

PROCESS OF AND APPARATUS FOR TREATING MALT LIQUORS.

SPECIFICATION forming part of Letters Patent No. 568,132, dated September 22, 1896.

Application filed December 13, 1895. Serial No. 572,005. (No model.)

To all whom it may concern:

Be it known that I, ALFRED E. FEROE, of Madalin, Tivoli village, Dutchess county, State of New York, have invented a new and useful improved process of and apparatus for treating malt liquors without the employment of kraeusen, finings, shavings, or artificial carbonation, and for treating ale so that it can be drawn as cool and brilliant as lager-beer, of which the following is a specification.

The invention herein described consists of improvements on the apparatus and process described and shown in United States Letters Patent No. 215,338, granted to A. E. and W. E. Feroe, dated May 13, 1879, and improvements in processes of and apparatus for filtering and retaining the gas in beer while filtering and barreling it. The process described in United States Letters Patent No. 215,338 was principally adapted in its details to the making of very lively present-use ales. The changes in and additions to said older process as set forth herein are for the purpose of adapting the former invention in its details to the manufacture of lager-beer and still ales in which a comparatively low pressure is required.

Accompanying this specification, to form a part of it, there is a sheet of drawings containing four figures illustrating my improved apparatus.

Of the illustrations, Figure 1 is a side elevation of the apparatus with the upper and lower tanks and cooler shown in vertical section. Fig. 2 is a horizontal section of the cooler, taken on the line x x of Fig. 1. Fig. 3 is a vertical section taken through part of the side, part of the bottom of the upper tank or cylinder, and also through the draw-off pipe and its stuffing-box. Fig. 4 is a section taken on the line x^2 x^2 of Fig. 1, showing part of the upper tank, the intake of the draw-off pipe being indicated within the tank as turned up and down by a dotted line.

The several parts of the apparatus thus illustrated are designated by letter-reference, and the function of the parts is described as follows:

The letter A designates the upper one of the two cylinders or tanks, both of which stand vertically. The cylinder or tank A is provided with a closed top, which can be removed for cleaning the tank interior, and with its top there is connected a supply-pipe d', by which beer is discharged into the tank A from a fermenting tank or tun. (Not shown.) This cylinder or tank A is provided with an interiorly-placed cylinder a^2, which is open at its top and bottom and within which last-named cylinder there is arranged a vertical shaft a^3, made to journal in a gas-tight connection in the top and bottom of the tank or cylinder A. The upper end of the vertical shaft a^3 is provided with a pulley a^4, by which said shaft may be rotated.

The letter a^5 designates an agitator having the form of a conveyer or propeller wheel by which when the shaft a^3 is rotated the beer will circulate up through the inner cylinder a^2 to pass out of its top and downwardly between the exterior of the cylinder a^2 and the interior of the cylinder or tank A for circulation and equalization of temperature. This tank or cylinder A is provided with an observation-window O′, located in the side of the tank near its top, and O² another observation-window located in the side of the tank near its bottom, by which the condition of the beer within the tank or cylinder A may be observed.

The letter W designates a water-gage located in the side of the tank or cylinder A, by which the quantity of liquid contained in the tank may be determined.

The letter C′ designates a coil of pipe arranged within the tank or cylinder A, by which hot or cold water may be passed through said pipe to increase or diminish the temperature of the beer within the tank and thus maintain the desired temperature to attain the best results.

The letter I designates a safety-valve connecting with the tank or cylinder A, and the letter M designates a thermometer which also connects with the tank A.

The letter G designates a pressure-gage which is connected to the pipe i^2, leading from the tank A.

The letter L designates an adjustable draw-off cock or pipe arranged to have its horizontal part turn in a stuffing-box l^2, and where extended outside of the tank this pipe L is

provided with a turn-handle by which its intake upturned end l^3 where within the tank may be turned so as to draw off beer at a higher or lower point or level above the sediment. The outer end of this pipe L connects with the pipe d^5 by means of a ball-and-socket joint B^6 in which to turn and be operated by the handle h, and this pipe d^5 connects at its lower end with the cooler J and leads from the latter to connect with the bottom of the filtering-cylinder B, and it is provided with valves v^9 and v^2.

The letter P designates an air-pump operated by a steam-cylinder R, and d^2 a pipe connecting with said pump and the cylinder or tank A and intermediately with the pipe d^4, the latter being provided with the valve v^8, and the connecting-pipe d^2 with valves v^4 and v^5 and the pipe d^3, with which the pipes d^2 and d^4 connect, the former having a valve v^6, by which means, when the valves v^4 and v^5 are open and the valves v^7 and v^6 closed, air or carbonic-acid gas may be supplied by the pump P to the tank A for pressure. The pipe d^5 connects with the circulating-pipe C^2, arranged to run back and forth in the cooler J, and the discharge end of this pipe C^2 also connects with the pipe d^5 where leading to the filtering-tank of cylinder B. This cooler J, through which the beer is passed by means of the pipe C^2, consists of a rectangular inclosure j^2, provided with vertical partitions j^3, which connect with the bottom of the inclosure and the ends of the latter, so as to break joints and thus produce a circulating-passage for the pipe C^2, the latter passing through the cooler in the direction indicated by arrows, and brine cooled down to a low temperature entering the cooler at e^2 and passing out therefrom at e^3 in the direction indicated by arrows, the cold brine moving in a direction opposite to that of the beer in the pipe C^2. The cooler J may be used or its use omitted, as conditions of temperature may necessitate.

The filtering-tank B has a closed top T^2, adapted to be removed for cleaning the interior of the tank, and the latter is provided with a centrally-located stuffing-box t^2, arranged centrally in the tank-top for the passage of a piston rod or bar b^4, operating the filter F, and by which means the filter may be raised or forced downwardly in the tank B. This filter F at its perimeter is provided with a rubber flange or packing f^3, by which it is adapted to make a piston engagement with the interior of the tank B in which it is located. This filter between its center and piston-form rim is on its outer upper and its under face provided with a wire-gauze covering g^6, having intermediately-placed perforated or corrugated plates g^7, having passages through them, there being interposed between them any suitable material g^8, which will, on the passage of the beer through it, take from the latter all substances tending to make it cloudy or murky. When moved downwardly, this filter is adapted to have its flanged edge rest on the bottom of the tank or cylinder.

The letter g^3 designates a gage for ascertaining the vertical depth of the liquid in the tank B to which it is attached.

The letter n designates a pipe which is upcast from the side of the tank or cylinder B, and upon this pipe there is arranged a safety-valve S^5 and a pressure-gage H, which latter will indicate the pressure upon the beer above the piston-form filter when the latter is being moved downwardly, and the letter H^2 another pressure-gage, which will indicate the pressure upon the beer below the piston when the latter is moved downwardly, and the letter M^2 designates a thermometer connected to the side of the filtering-tank B.

The letter d^9 designates a pipe leading from the bottom of the tank B to a racking apparatus A^2, connected with the bung-hole of the barrel B^3, said pipe connecting with the tank B above the filter after the latter has been moved downwardly to rest on the bottom of the cylinder B, and d^6 a pipe provided with valves v^{11} and v^{13}, connecting the racking apparatus with the top of the cylinder A to equalize the pressure upon the tanks and barrel when the valves on the pipes d^9 and d^6 are open. The pipe d^3 connects with the discharge-pipe of the safety-valve I on the tank or cylinder A, and also with the pipe d^4, leading downwardly to enter the top of the filtering-cylinder B, so that when the valves v^5 and v^4 on the pipe d^2, leading to the pump and tank A, are closed, and the valve v^6, on the pipe d^3, as well as the valve v^8, are open, all excess of pressure on the tank or cylinder A is transferred to the filtering-cylinder B for maintaining an equilibrium of pressure on the two tanks.

When employing the apparatus herein illustrated and described to carry out my improved process, the application of its several process steps in the treatment of malt liquors is accomplished as follows: The liquor is confined under a pressure greater than that produced by fermentation (as in the cylinder A) with the liquor at that stage of the fermentation when nearly ready to rack into barrels or casks for future use or storage, and allowed to stand therein until the yeast and sediment have settled and the fermentation and carbonation completed, the applied pressure facilitating sedimentation. The liquor is then drawn off from above the sediment and is cooled to such an extent as will render insoluble the semisoluble albuminoids, which tend to cloud the liquor when cold, with the liquor then still under pressure passed upwardly through a filter, whereby there is none of the loss of gas which occurs when the liquor is agitated and filtered by its descent under the action of gravity, thus employing sedimentation under pressure for the removal of the yeast and other settlings and the completion of the fermentation, then cooling it and filtering it. My improved process in

these respects differs from an older process in which liquors poor in carbonic-acid gas were cooled and filtered, and to which carbonic-acid gas was afterward added, or to another older process in which the liquor was subjected to the main fermentation, then passed through a filter without previous sedimentation under pressure before filtration, then carbonated by kraeusen, or to which carbonic-acid gas was afterward added to carbonate it.

When operating my improved apparatus for the various purposes for which it is designed, it is used as follows: All the valves on the pipes are closed excepting the valve v^7 on the pipe d', when the fermenting liquid is run into the tank A from the fermenting tank or tun through the pipe d' until the tank is filled to a proper depth, as indicated by its upper sight-opening o', or by its liquid-gage, with the liquid when it has nearly reached that stage of fermentation in which it is usually barreled or put into large casks for storage. If desired, at this stage of the operation any suitable fermentable substances may be employed by adding them to the liquid; but I prefer to omit their use, as it takes more time to get the beer in condition for use, which is objectionable. After the tank A has been thus filled to a proper height close the valve v^7 on the pipe d' and open the valves v^4 and v^5 on the pipe d^2, and by means of the pump P force into the tank A air until the pressure, as indicated on the gage G, will be sufficient to prevent the insoluble matter produced by the fermentation while within the tank A from rising to the surface of the beer. The proper temperature for fermentation may be had or maintained by passing warm or cold water through the coil C within the tank A, as occasion requires. By slowly operating the shaft a^3 the propeller-wheel or agitator will keep in motion all the beer above the settlings without disturbing the settlings. By reversing the motion of the propeller-wheel and running it rapidly it will rouse the beer to facilitate fermentation when desired. When the fermented liquor in tank A is in the proper condition to filter and rack, if it be ale, it should be cooled down to several degrees below the temperature at which it is to be drawn for consumption by passing it through the cooler J. This will render the semisoluble albuminoids insoluble, so that they can be removed by filtration. If the liquor be lager-beer, it will usually be cool enough without further cooling before filtration.

During the fermentation in the tank or cylinder A the excess of carbonic-acid gas developed when exceeding the required pressure will, by the safety-valve I, be discharged into the tank B by means of the pipes d^3 and d^4, with the valves v^6 and v^8 open and the valves v^5 and v^4 closed, thus maintaining an equilibrium of pressure on the tanks A and B, if sufficient gas is formed by the fermentation. If not enough is produced, the deficiency must be made up by pumping air into tank B before running the beer from tank A into tank B, and when any excess of pressure is forced into the latter tank it is relieved by the safety-valve S^5.

When the fermentation in the tank A has reached its termination or the beer has reached a proper condition for filtering, the valves v^2 and v^9 on the pipe d^5 are opened, and the beer will flow by gravity from the tank A into the filtering-tank B or the cooler J, through the latter to the filter F, having been raised to the upward limit of its movement, the upturned end of the draw-off pipe L (indicated at l^3) will be above the line of the sediment in the bottom of the tank or cylinder A, and as the lower stratum of the beer immediately above the sediment reaches the end of the draw-off pipe the latter may be turned by its handle h so as to draw the beer from off the latter without disturbing it, the window O^2 making clearly visible the position of the beer over the sediment, and the extent to which the draw-off pipe may be turned to closely draw off the beer without disturbing the sediment.

As the beer flows through the pipe d^5 into the filtering tank or chamber the valve v^2 on the pipe d^4 is opened, likewise the valve v^4 on the pipe d^2 with the valve v^6 closed, by which connection the gas and air in the chamber of the filtering cylinder or tank B are displaced by the entering beer will be discharged into the cylinder or chamber A, thus maintaining a uniform pressure in both cylinders. When all the beer contained in the tank or cylinder A has thus passed into the filtering-tank, a strong additional pressure can be placed on the beer by pumping air into tank B in excess of the gas-pressure in the beer. The more the gas in the latter is compressed while filtering the finer will be the head on it. The valves v^8 and v^9 should be closed and the filter moved slowly downward by power applied to its piston-rod until it reaches the bottom of the tank, the beer passing up through the filter with all the flocculent and other suspended matter being caught by the filter, and with the latter resting on the bottom of the tank-interior slightly below the discharge-pipe d^9, leading to the racking apparatus. This manner of filtering beer under compression produced by a greater pressure on the beer than that of the gas-pressure in it, and by the action of a filter forced downwardly through the beer without agitating it, forms a prominent feature of my invention, by which practically all the gas in the beer is retained, which cannot be done by passing beer through a filter in the usual way under insufficient pressure and the agitation attending the present methods. By my improvement the applied pressure upon the beer cooperates with the pressure of the filter in its descent to prevent the separation of the nascent carbonic-acid gas produced in the beer

from fermentation. Instead of the filter shown and described any well-known form of filter which will perform like functions may be used, and while I have described my improved process as applied to the treatment of still ales and lager-beer, it may also be used for the treatment of very lively present-use ales.

While my improved process may be carried out by using the apparatus which I illustrate and describe, I do not limit my improved process to the use of the particular means which I illustrate and describe, as other apparatus may be used to perform the same process-steps in their same order.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In the manufacture of ales and other fermented liquors, the herein-described process of treating them previous to filtration, which consists in confining fermenting hopped beer-wort in a tight vessel at that stage of fermentation when its subsequent fermentation in said tight vessel will sufficiently carbonate it for use, then facilitating sedimentation by applied pressure, then carbonating it by its own fermentation while under the applied pressure, ripening it by continued fermentation, and, when sufficiently carbonated, separating it from the yeast and sediment precipitated by the applied pressure, then cooling it to render the semisoluble albuminoid matter in it insoluble so that it may be removed by filtration, substantially as set forth.

2. The herein-described process of treating carbonated ales and other fermented liquors, which consists in fully carbonating them for use; subjecting them to sedimentation under applied pressure, drawing them off from above the yeast and sediment, cooling them to render the semisoluble matters insoluble, then filtering them under a uniform circulating pressure equal to or in excess of the gas-pressure in the carbonated liquors, substantially as set forth.

3. The herein-described process of producing chilled and filtered ales and other fermented liquors, naturally carbonated for use, which consists in carbonating them by their own fermentation and drawing them off from the sediment precipitated during fermentation, then subjecting them to a cooling process to render the semisoluble matters insoluble, then conducting them into a tight vessel and passing a filter downwardly through them, while under pressure and practically without agitation, thereby retaining all their gas and flavor and removing the insoluble matters from them, substantially as set forth.

4. The herein-described process of treating and preparing ales and other fermented liquors for use, which consists in confining the partly-fermented liquor in a tight vessel at that stage of fermentation when nearly ready to rack into packages for use, or in casks for storage; subjecting it to sedimentation under applied pressure and to carbonation by a continued fermentation, with its own gas, ripening it by continued fermentation, separating it from yeast and sediment precipitated during fermentation, cooling it to contract and more thoroughly retain the gas, as well as to render the semisoluble matters insoluble, then filtering and racking it under a uniform circulating pressure, equal to or in excess of its own gas-pressure.

5. In an apparatus for treating malt liquors, the combination with a tank or cylinder provided with an inlet-pipe for the entering liquor, and a pipe for its discharge, and an inlet-pipe by which gas may be forced into said tank for pressure, of an observation-window at the top and bottom of the tank formed in the cylinder sides; a coil arranged within said tank for the circulation therein of warm or cold water; a cylinder open at the top and bottom arranged within said tank; and a vertical shaft journaled in the top and bottom of said tank, and where passing through the interior cylinder, provided with a conveyer-wheel, whereby the liquor may be caused to circulate in said tank, substantially in the manner as and for the purposes set forth.

6. The combination with the tank A, having the inlet-pipes d', d^2, and outlet-pipe d^5, provided with valves, and having the observation-windows O′ and O², constructed and arranged substantially as described; of the interior cylinder a^2, open at the top and bottom; and provided with the interior shaft a^3, having thereon the conveyer or propeller wheel a^4, said shaft being journaled in the top and bottom of the tank A; and the turn-down draw-off pipe L, connecting with said tank A, and the pipe d^5, substantially as and for the purposes set forth.

7. The combination with the tank A, provided with the supply-pipe d', and gas or air pipe d^2, of the temperature-regulating coil-pipe C′, arranged within said tank A; the interior cylinder a^2, open at the top and bottom, and arranged within said tank; the vertical shaft a^3, centrally journaled in the top and bottom of said tank; the propeller a^5, arranged upon said shaft where within the cylinder a^2, and the draw-off cock or pipe L, constructed and arranged to operate substantially in the manner as and for the purposes set forth.

8. The combination with a cylinder A, constructed and arranged to receive malt liquor from a tun or cask, and provided with an observation-window at its side near its bottom, of the draw-off cock L, having an upturned end where within the tank and provided with a handle where extended through and beyond the tank, and a ball-socket connected with a stationary conduit-pipe by which handle said upturned end of the pipe may be turned so as to draw liquor from the tank at different levels, substantially as shown and described.

9. In an apparatus for treating malt liquors under pressure, other than that generated by the fermentation of the liquor, the combina-

tion with a cylinder provided with intake means for liquor and pressure, and a safety-valve, a draw-off cock, an interiorly-arranged circulating-coil, through which warm or cold water may be passed to regulate the temperature, and having an interiorly-placed cylinder, open at top and bottom, and a vertical shaft provided with a conveyer-wheel whereby a circulation may be maintained in the tank above the sediment, substantially as described; of a filtering-cylinder arranged below the before-named tank, said filtering-cylinder being provided with a piston-form filter operated to move downwardly through the liquor, and pipes connecting the filtering-cylinder and the upper cylinder, whereby the pressure in both is equalized, substantially as shown and described.

10. In an apparatus for treating malt liquors under pressure other than that generated by the fermentation of the liquor, the combination with a tank or cylinder having an inlet-pipe for the liquor and a pipe for the gas-producing pressure, both of which pipes are constructed with suitable valves, and provided with a safety-valve, observation-windows, a draw-off cock, and having an interior coil for regulating temperature, and provided with an interior cylinder containing a vertical shaft and propeller-wheel for agitating the liquor above its sediment; of a filtering-cylinder having a closed top arranged below the before-named tank, and provided with a pipe leading from the upper tank or cylinder, and having a piston-form filter arranged to be passed downwardly through the liquor in the filtering-tank, and a pipe connecting the upper tank and filtering-cylinder whereby the pressure upon the latter and the upper tank are equalized, substantially in the manner as and for the purposes set forth.

11. In an apparatus for treating malt liquors under pressure other than that generated by the fermentation of the liquor, the combination with a tank or cylinder provided with an inlet-pipe for entering liquor, and a pipe for its discharge, and an inlet-pipe by which gas or air may be forced into the tank, said pipes having suitable valves; and a safety-valve on said tank; of a coil arranged within said tank where by the use of warm or cold water therein the temperature of the liquor may be regulated; and an interior cylinder open at the top and bottom within said tank, said cylinder having an interiorly-arranged conveyer or propeller mounted on a shaft whereby circulation of the liquor above its sediment may be had; a cooler connected with the pipe leading from said tank; a filtering-cylinder located below the before-named cylinder and provided with a piston-form filter operated to descend through the liquor contained therein; a pipe connecting said cooler with the filtering-chamber, and a pipe connecting said filtering-cylinder with the upper tank whereby an equalized pressure is had upon both, substantially as and for the purposes set forth.

12. The combination with the tank A, provided with an inlet-pipe d', for supplying malt liquor, and the pipe d^2, for delivering gas or air to produce pressure upon said tank, said pipes having suitable valves, of a draw-off pipe or cock L, connected to the lower side of said tank A; the filtering-cylinder B, arranged below the tank A, and provided with the pipe d^5, connecting said filtering cylinder with the draw-off cock L; the piston-form filter F, operated to be moved down through the liquor in the tank B; the pipe d^4, connecting the top of the filtering-tank with the top of the tank A; the pipe d^9, connecting with the filtering-cylinder above the filter F, when moved downwardly to rest on the tank-bottom, and also connecting with a racking apparatus; and a pipe d^6, connecting the latter with the top of the tank A, substantially in the manner as and for the purposes set forth.

13. The combination with the tank, A, provided with an inlet-pipe, d', whereby gas or air pressure may be applied to the interior of said tank, of the safety-valve, I, connected to said tank, A, the filtering-tank, B, provided with a safety-valve, S^5, the draw-off pipe, L, the pipe, d^5, connecting said draw-off pipe with the tank, B, the pipe, d^3, connected with the safety-valve, I, on tank, A, and with the tank, B, by which any overpressure on the tank, A, may be transferred to tank, B, and any overpressure on the latter be discharged by the safety-valve, S^5, substantially as set forth.

14. In apparatus for treating fermented liquor and for barreling it, under pressure, the combination with the tank A, for the treatment and sedimentation of the carbonated liquor; of the cooler J, connecting with said tank A; the filtering-cylinder B, and a pipe connecting the latter with said cylinder A; and a pipe connecting the top of the latter with the top of the tank B; a pipe connecting said cylinder B, below its filter with a racking apparatus, and a pipe connecting the latter with the top of the tank A, said pipes being provided with valves whereby an equalized pressure may be maintained in said tanks and racking apparatus and barrel, substantially as shown and described.

15. In an apparatus for clarifying and barreling malt liquors under pressure, the combination with a tank for containing the liquor during the completion of the sedimentation, and fermentation, and provided with a pipe for supplying pressure thereto and also provided with a heating and cooling coil; a cooler; a filtering apparatus; a pipe connecting said tank with the cooler and provided with a valve; a pipe connecting said cooler with the filtering apparatus, and provided with a valve; a pipe provided with a valve connecting said filtering apparatus with a

racking apparatus; and a pipe provided with a valve connecting said racking apparatus with the top of said tank, whereby the air-pressure displaced in the barrel by the entering liquor will be conveyed to said tank, and the pressure upon the liquor within the barrel be retained, to prevent any loss of gas substantially as and for the purposes set forth.

Signed at Troy, New York, this 10th day of December, 1895, and in the presence of the two witnesses whose names are hereto written.

ALFRED E. FEROE.

Witnesses:
CHARLES S. BRINTNALL,
W. E. HAGAN.